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or user name). As one example, a user's identity may be treated so that no personally identifiable information can be determined. As another example, a user's geographic location or a location associated with user images may be generalized to a larger region so that the user's particular location cannot be determined.

Note that the functional blocks, operations, features, methods, devices, and systems described in the present disclosure may be integrated or divided into different combinations of systems, devices, and functional blocks as would be known to those skilled in the art. Any suitable programming language and programming techniques may be used to implement the routines of particular implementations. Different programming techniques may be employed, e.g., procedural or object-oriented. The routines may execute on a single processing device or multiple processors. Although the steps, operations, or computations may be presented in a specific order, the order may be changed in different particular implementations. In some implementations, multiple steps or operations shown as sequential in this specification may be performed at the same time.

We claim:

1. A method comprising:

receiving a video including a plurality of frames, the video captured by a physical camera at a first point of view, wherein the video includes depth information corresponding to the plurality of frames;

detecting a face within the video, wherein the face is within a foreground portion of the plurality of frames, and wherein detecting the face includes determining that an angle of the face about one or more axes is within a threshold range; and

in response to detecting the face:

determining the foreground portion of the plurality of frames based on one or more depth values of the depth information corresponding to the plurality of frames;

positioning a virtual camera at a second point of view, wherein the second point of view is different from the first point of view;

obtaining a projection matrix of the foreground portion based on the virtual camera, the projection matrix corresponding to the second point of view; and

generating a modified video that includes a modified foreground portion based on the projection matrix.

2. The method of claim 1, further comprising adjusting the projection matrix of the foreground portion to reduce a lens effect of the physical camera used to capture the video.

3. The method of claim 1, wherein detecting the face further comprises extracting the face out of a background plane, wherein the background plane is determined based on the depth information.

4. The method of claim 3, further comprising rotating the background plane to face the virtual camera at the second point of view.

5. The method of claim 1, wherein determining the foreground portion includes detecting a background, and wherein the detecting the background includes extruding the foreground portion of the face from the background.

6. The method of claim 5, wherein detecting the background includes:

detecting face depth based on the depth information; determining a depth within the frames of an outer edge of the face; and

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setting the background to include portions of the frames at the depth of the outer edge of the face and at depths beyond the outer edge of the face.

7. The method of claim 6, further comprising blurring the background.

8. The method of claim 1, further comprising:

determining a temporal history of depth information of the video; and

performing hysteresis of video re-projection using the temporal history of the depth information of the video so as to maintain continuity of a re-projection and not respond to temporary objects moving in front of the face being re-projected, wherein the temporary objects are in front of the face being re-projected for less than a threshold period of time.

9. A system comprising:

one or more processors coupled to a non-transitory computer readable medium having stored thereon software instructions that, when executed by the one or more processors, cause the one or more processors to perform operations including:

receiving a video including a plurality of frames, the video captured by a physical camera at a first point of view, wherein the video includes depth information corresponding to the plurality of frames;

detecting a face within the video, wherein the face is within a foreground portion of the plurality of frames of the video, and wherein detecting the face includes determining that an angle of the face about one or more axes is within a threshold range; and

in response to detecting the face:

determining the foreground portion of the plurality of frames based on one or more depth values of the depth information corresponding to the plurality of frames;

positioning a virtual camera at a second point of view, wherein the second point of view is different from the first point of view;

obtaining a projection matrix of the foreground portion based on the virtual camera, the projection matrix corresponding to the second point of view;

generating a modified video that includes a modified foreground portion based on the projection matrix; and

stabilizing the modified foreground portion of the modified video.

10. The system of claim 9, wherein the operations further comprise adjusting the projection matrix of the foreground portion to reduce a lens effect of the physical camera used to capture the video.

11. The system of claim 9, wherein detecting the face further comprises extracting the face out of a background plane, wherein the background plane is determined based on the depth information.

12. The system of claim 11, wherein the operations further include rotating the background plane to face the virtual camera at the second point of view.

13. The system of claim 9, wherein determining the foreground portion includes detecting a background, and wherein the detecting the background includes extruding the foreground portion of the face from the background.

14. The system of claim 13, wherein detecting the background includes:

detecting face depth based on the depth information; determining a depth within the frames of an outer edge of the face; and